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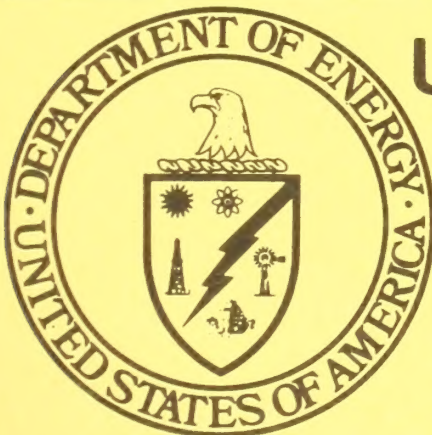
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SOLAR/2010-79/06

Monthly Performance Report

CHARLOTTE MEDICAL CENTER

JUNE 1979



U.S. Department of Energy

National Solar Heating and
Cooling Demonstration Program

National Solar Data Program

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MONTHLY PERFORMANCE REPORT
CHARLOTTE MEDICAL CENTER
JUNE 1979

I. SYSTEM DESCRIPTION

The Charlotte Medical Center, Charlotte, North Carolina, solar energy system was designed to provide both space heating and domestic hot water for a six-story medical library, office and classroom building. Solar energy collection is accomplished by an array of General Electric flat-plate collectors using a 50 percent (by volume) aqueous solution of ethylene glycol. The collector array has a gross area of 4,020 square feet and faces south at an angle of 35 degrees from the horizontal. Storage capacity is 6,000 gallons of water in an underground tank. In addition to the primary storage tank, there are three domestic hot water (DHW) tanks, each of which has a capacity of 125 gallons. Auxiliary heating for both subsystems is provided by electrical resistance heaters. Each DHW tank contains a 12 kw electrical immersion heater. The space heating subsystem has a capacity of 261 kw, of which 11 kw is contained in supplementary baseboard heaters on the first floor of the building.

The system, shown schematically in Figure 1, has six basic modes of operation.

Mode 1 - Collector-to-Space Heating: This mode is entered whenever there is a demand for space heating and the solar panel temperature is above 100°F. Pump P1 is started when the solar panel temperature first rises above 100°F, and will continue to run while either the solar panel temperature is above 85°F, or the water thermal storage temperature is above 85°F and the air-handling unit (AHU) is calling for heat. In this mode, pump P1 circulates the solar heated ethylene glycol solution from the collectors, through valve V2, heat exchanger HX2, valve V1, valve V4 and back to the collectors. Thus, the solar heated solution flows from the collectors directly to the space heating exchanger HX2; storage loop heat exchanger HX4 is bypassed.

- I001 COLLECTOR PLANE TOTAL INSOLATION
- ▼ T001 OUTDOOR TEMPERATURE
- V001 WIND SPEED
- D001 WIND DIRECTION
- ▼ T600 INDOOR TEMPERATURE
- EP401 FIRST FLOOR AUXILIARY BASEBOARD HEAT

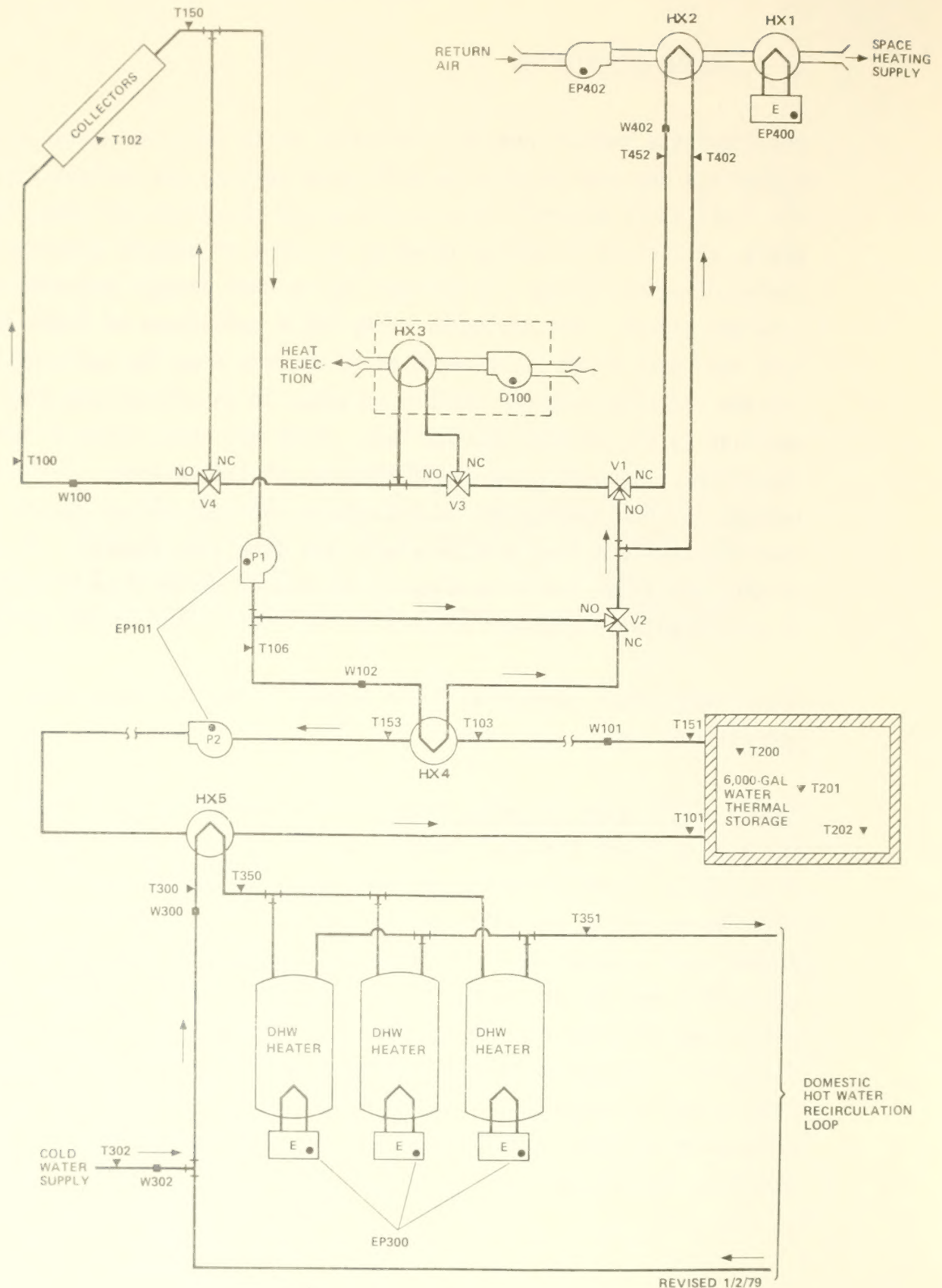


Figure 1. CHARLOTTE MEDICAL CENTER SOLAR ENERGY SYSTEM SCHEMATIC

Mode 2 - Collector-to-Space Heating and Storage: With the water thermal storage temperature below 85°F and the AHU calling for maximum heat, AHU heating valve V1 is fully open to the AHU heating coil HX2 and valve V2 is in the normally open position. As the heating demand becomes satisfied, valve V1 is modulated toward the by-pass position and valve V2 is modulated open to the storage heat exchanger HX4. When valve V2 begins to open to heat exchanger HX4, pump P2 is started, charging the 6,000-gallon water thermal storage. After the storage temperature increases above 85°F, pump P2 runs continuously to provide DHW preheat through heat exchanger HX5.

Mode 3 - Collector-to-Storage: This mode is entered when the system is running, there is no demand for space heating, and the solar panel temperature is greater than the storage temperature. During this mode, valve V2 is open to heat exchanger HX4 so that collected solar energy is delivered to storage. However, in the event that the storage temperature is greater than the solar panel temperature, valve V2 returns to the full by-pass position.

Mode 4 - Storage-to-Space Heating: This mode is entered whenever the solar panel temperature is below 85°F, the storage temperature is greater than 85°F, and there is a demand for space heating. Since the storage temperature is above 85°F, pump P2 is operating. When the AHU controls call for heating, pump P1 is started. If the solar panel temperature is below 85°F, valve V2 is positioned full open to heat exchanger HX4, and valve V4 is positioned to by-pass the solar panels. Hot water from storage is now pumped through heat exchanger HX4. Pump P1 circulates the transport fluid through the load side of heat exchanger HX4 and the AHU heating coil HX2 as determined by modulating valve V1.

Mode 5 - Excess Solar Heat Rejection: This mode is entered if the solar loop temperature increases above 200°F. Valve V2 goes to the full by-pass position and valve V3 opens to allow excess solar heat to be rejected to the atmosphere through heat exchanger HX3. Pump P2 continues to operate to preheat service hot water and valve V2 modulates to maintain a maximum temperature of 200°F in the water thermal storage.

Mode 6 - Domestic Water Preheat: This mode is entered whenever storage temperature is greater than 85°F. Pump P2 circulates water from storage through hot water heat exchanger HX5.

II. PERFORMANCE EVALUATION

The system performance evaluations discussed in this section are based primarily on the analysis of the data presented in the attached computer-generated monthly report. This attached report consists of daily site thermal and energy values for each subsystem, plus environmental data. The performance factors discussed in this report are based upon the definitions contained in NBSIR 76-1137, Thermal Data Requirements and Performance Evaluation Procedures for the National Solar Heating and Cooling Demonstration Program.

A. Introduction

The operation of the Charlotte Medical Center solar energy system during June was limited to a considerable extent by improper control system behavior. There were several days during the month when the insolation level was high enough to permit solar energy collection but collector array flow was either sporadic or nonexistent. This was similar to system behavior in April and May but the opposite of the situation that occurred during March when collector array flow often continued into the late evening hours. These control problems have been discussed in detail in prior reports and the site contractor is addressing the problem. Although experiencing control problems, the system realized a net hot water and space heating electrical energy savings of 4.45 million Btu for the month. A total of 5.66 million Btu of electrical operating energy was required to support the system during June.

B. Weather

During June, the measured average outside ambient temperature was 73°F. This was three degrees below the long-term average ambient temperature of 76°F and

had little effect on the building heating load. Long-term temperature data are taken directly from data supplied by the National Oceanic and Atmospheric Administration's Local Climatological Data Bulletin for Charlotte.

The measured value for incident insolation in the plane of the collector array was $1,345 \text{ Btu/ft}^2\text{-day}$, and this was 19 percent below the long-term average of $1,653 \text{ Btu/ft}^2\text{-day}$. However, the measured value of insolation is in error due to a pyranometer shading problem. The pyranometer is shaded at times during the day by the instrument that monitors wind velocity and direction, so the actual value for measured insolation is apparently higher than that reported. Long-term insolation in the plane of the collector array is derived from data for Charlotte taken from the SOLMET Volume 1 - User's Manual.

C. System Thermal Performance

Collector - During June, the Charlotte solar energy system collected a net amount of 17.68 million Btu. However, approximately 0.42 million Btu were lost by the collector array due to the erratic operation caused by the control system. Also, an additional 0.32 million Btu were deliberately rejected by the heat rejection fan, and this situation was also a direct result of the sporadic collector array operation. On bright days, the fluid in the collector loop would exceed temperatures of 200°F during stagnation periods and this caused the heat rejection fan to come on for short periods of time.

A total of 162.19 million Btu of incident solar energy was measured in the plane of the collector array during June. However, as previously noted, a net amount of only 17.68 million Btu was collected. This was due to the limited amount of array operating time. As a result, the reported collector array efficiency was only 11 percent.

Storage - During June, a total of 16.49 million Btu was delivered to storage. Of this total, 16.39 million Btu came from the collector array, and 0.10

million Btu came from the hot water recirculation loop. The energy from the hot water recirculation loop can be traced back to the electrical auxiliary heaters in the DHW heater tanks. This is a system design problem which was discussed in detail in the November 1978 report.

A total of 18.58 million Btu was removed from storage during the month. However, approximately 0.42 million Btu of this energy was rejected to the atmosphere because of the control problems.

The change in stored energy was -1.37 million Btu, and this, plus the energy supplied to and removed from storage, indicates a slight thermal gain for the storage subsystem during the month (this is within the accuracy limitations of the system instrumentation). Storage was maintained at an average temperature of 121°F.

Hot Water Load - The hot water load for May was 1.52 million Btu. This is based on an average supply water temperature of 78°F, an average service hot water temperature of 117°F and an average daily consumption of 142 gallons. Solar energy supplied to the hot water subsystem amounted to 6.74 million Btu. However, because of a design problem with the recirculation loop in the hot water subsystem, a total of 0.10 million Btu of electrical auxiliary energy was delivered from the service hot water tanks to the solar energy storage loop. This resulted in a net energy delivery to the hot water subsystem of 6.64 million Btu. This design problem was discussed in detail in the November 1978 report.

The indicated hot water solar fraction of 96 percent is based only on periods when solar energy was being delivered to the hot water subsystem. During periods when auxiliary energy was being delivered to the solar energy storage loop, the hot water solar fraction was considered to be zero.

It should be noted that in spite of the design problem and erratic collector array performance, the hot water subsystem was supported almost entirely by the solar energy system in June.

Approximately 0.27 million Btu of auxiliary electrical energy were delivered to the hot water subsystem. Therefore, a total of 7.01 million Btu was actually used to support the hot water subsystem. Since the actual hot water load was 1.52 million Btu, and 0.10 million Btu were delivered back to the solar energy storage loop, the total losses for the hot water tanks and recirculation loop piping amounted to 5.39 million Btu for June.

Space Heating Load - The space heating load for June was 64.74 million Btu. Solar energy supplied 3.47 million Btu of this load, which resulted in a heating solar fraction of five percent. The remaining 61.24 million Btu of energy required to support the space heating subsystem were supplied by the electrical auxiliary system. The main auxiliary system supplied 34.85 million Btu and the supplemental baseboard system on the first floor of the building supplied 26.39 million Btu.

The energy consumed by the main auxiliary system was primarily used for purposes of building dehumidification, rather than actual space heating. This dehumidification was done during the 11-day period from June 18 through June 28.

Although the performance of the space heating subsystem appears low for June, it must be realized that 43 percent of the auxiliary energy supplied to the building was utilized in the medical library area on the first floor. This area was not designed to receive any significant support from the solar heating subsystem even though it must be included in the total building heating load computation. Therefore, any time the main portion of the building heating load is small (or nonexistent), the heating solar fraction will be low if any auxiliary heat is used in the library area. Also, the dehumidification process discussed above served to decrease the indicated subsystem performance.

The total energy delivered to the building maintained an average interior temperature of 71°F. The average outside ambient temperature was 73°F.

D. Observations

The June operation of the Charlotte Medical Center solar energy system was somewhat contrary to the system design. The abnormal operation, in conjunction with the control system and hot water subsystem design problems, degraded system performance to some extent.

E. Energy Savings

During the month of June, the Charlotte solar energy system realized a net electrical energy savings of 4.45 million Btu. The space heating subsystem and hot water subsystem operation saved a total of 10.11 million Btu, but this was reduced by the 5.66 million Btu of electrical energy required to operate the system.

III. ACTION STATUS

The system problems were previously brought to the attention of the system designer and the situation is under detailed investigation. A modification to the present control system has been proposed and submitted to the Marshall Space Flight Center for approval.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT SITE SUMMARY

SITE: CHARLOTTE MEM. HOSP. & MED. CENT.
REPORT PERIOD: JUNE, 1979

SOLAR/201C-79/06

SITE/SYSTEM DESCRIPTION: THE CHARLOTTE SOLAR SYSTEM PROVIDES HEATING AND HOT WATER FOR THE AREA HEALTH AND EDUCATION FACILITY. THIS FACILITY HAS 65,000 SQ. FT. CONTAINED IN SIX STORIES AND USES ELECTRICITY FOR AUXILIARY HEATING. THE CHW SYSTEM HAS THREE (3) 12 KW HEATERS AND THE SPACE HEATING SYSTEM HAS A 250 KW STRIP HEATER ALONG WITH 11.1 KW OF SUPPLEMENTAL BASEBOARD FEAT ON THE FIRST FLOOR.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY
162.187 MILLION BTU
40345 BTU/SQ. FT.
17.682 MILLION BTU
4398 BTU/SQ. FT.
73 DEGREES F
71 DEGREES F
0.06 MILLION BTU
5.664 MILLION BTU
10.620 MILLION BTU
89.816 MILLION BTU

COLLECTED SOLAR ENERGY

AVERAGE AMBIENT TEMPERATURE
AVERAGE BUILDING TEMPERATURE
ECSS SOLAR CONVERSION EFFICIENCY
ECSS OPERATING ENERGY
TOTAL SYSTEM OPERATING ENERGY
TOTAL ENERGY CONSUMED

SUBSYSTEM SUMMARY:

LOAD	FRACTION USED	FCT	WATER	HEATING	COOLING	SYSTEM TOTAL
SOLAR ENERGY USED	1.52C			64.726	N.A.	66.27C
OPERATING ENERGY	6.635			2.474	N.A.	10.114
AUX. THERMAL ENERGY	0.272			4.556	N.A.	10.62C
AUX. ELECTRIC FUEL	0.272			61.242	N.A.	61.514
AUX. FOSSIL FUEL	N.A.			61.242	N.A.	61.514
ELECTRICAL SAVINGS	6.635			2.474	N.A.	N.A.
FOSSIL SAVINGS	N.A.			2.474	N.A.	4.449
				N.A.	N.A.	N.A.

SYSTEM PERFORMANCE FACTOR:

C.276

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT
OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978,
SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT SITE SUMMARY

SITE: CHARLOTTE MEM. PCSP. & MED. CENT.
REPORT PERIOD: JUNE, 1979

SOLAR/201C-79/06

SITE/SYSTEM DESCRIPTION: THE CHARLOTTE SOLAR SYSTEM PROVIDES HEATING AND HOT WATER FOR THE AREA HEALTH AND EDUCATION FACILITY. THIS FACILITY HAS 65,000 SQ. FT. CONTAINED IN SIX STORIES AND USES ELECTRICITY FOR AUXILIARY HEATING. THE SYSTEM HAS THREE (3) 12 KW HEATERS AND THE SPACE HEATING SYSTEM HAS A 250 KW STRIP HEATER ALONG WITH 11.1 KW OF SUPPLEMENTAL BASEBOARD HEAT ON THE FIRST FLOOR.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY 171.108 GIGA JOULES
COLLECTED SOLAR ENERGY 458159 KJ/SC.M. JOULES
AVERAGE AMBIENT TEMPERATURE 18.654 GIGA JOULES
AVERAGE BUILDING TEMPERATURE 49948 KJ/SC.M. C
ECS SOLAR CONVERSION EFFICIENCY 23 DEGREES C
TOTAL OPERATING ENERGY 0.06 GIGA JOULES
TOTAL ENERGY CONSUMED 5.976 GIGA JOULES
94.756 GIGA JOULES

SUBSYSTEM SUMMARY:

LOAD	FCT	WATER	HEATING	COOLING	SYSTEM TOTAL
SOLAR FRACTION USED	1.604	96	68.297	N.A.	69.914
SOLAR ENERGY USED	7.004	96	3.665	N.A.	10.670
OPERATING ENERGY	N.A.	0.287	5.229	N.A.	11.204
AUX. THERMAL ENG	0.287	0.287	64.610	N.A.	64.898
AUX. ELECTRIC FUEL	N.A.	0.287	64.610	N.A.	64.898
AUX. FOSSIL FUEL	N.A.	7.004	3.665	N.A.	N.A.
ELECTRICAL SAVINGS	N.A.	N.A.	N.A.	N.A.	4.694
FOSSIL SAVINGS	N.A.	N.A.	N.A.	N.A.	N.A.

SYSTEM PERFORMANCE FACTOR:

0.276

- * DENOTES UNAVAILABLE DATA
- 2 DENOTES NULL DATA
- N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978, SOLAR/CCC4-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: CHARLOTTE MEM. FCSP. & MED. CENT.
REPORT PERIOD: JUNE, 1979
SOLAR/2010-79/C6

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	4.604	74	0.222	NOT APPLICABLE	0.193	0.000	0.060
2	6.095	75	0.220		0.211	0.000	0.036
3	2.753	73	0.232		0.166	0.000	0.065
4	4.982	71	0.208		0.186	0.000	0.047
5	5.293	72	0.208		0.175	0.000	0.049
6	2.381	73	0.190		0.170	0.000	0.080
7	6.228	77	0.250		0.197	0.000	0.043
8	7.271	78	0.221		0.208	0.000	0.034
9	4.632	77	0.229		0.215	0.188	0.052
10	8.104	77	0.331		0.175	0.000	0.043
11	7.199	77	0.323		0.189	0.000	0.038
12	6.353	77	0.247		0.191	0.033	0.040
13	0.564	78	0.152		0.179	0.000	0.045
14	2.502	78	0.196		0.069	0.000	0.070
15	7.307	78	0.223		0.192	0.000	0.052
16	5.327	78	0.228		0.223	0.000	0.037
17	5.331	77	0.242		0.212	0.000	0.045
18	2.918	77	0.224		0.194	0.000	0.055
19	6.999	77	0.254		0.188	0.057	0.046
20	6.101	76	0.229		0.184	0.000	0.077
21	3.449	76	0.225		0.209	0.000	0.020
22	6.294	76	0.259		0.203	0.053	0.042
23	8.305	76	0.332		0.171	0.000	0.061
24	6.822	74	0.266		0.183	0.000	0.041
25	6.726	74	0.271		0.188	0.000	0.036
26	5.479	75	0.241		0.199	0.000	0.049
27	6.244	75	0.312		0.204	0.000	0.035
28					0.216	0.000	0.021
29							
30							
SUM	162.187	-	10.114	N.A.	5.664	0.324	-
AVG	5.406	73	0.337	N.A.	0.185	0.011	0.062
NBS ID	Q001	N113			Q102		N111

* DENOTES UNAVAILABLE DATA.
 ‡ DENOTES NULL DATA.
 N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT COLLECTOR ARRAY PERFORMANCE

SITE: CHARLOTTE MEM. HCSP. & MEC. CENT. SOLAR/2010-79/06
REPORT PERIOD: JUNE, 1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	4.604	0.702	0.432	82.8	0.094
2	6.055	0.510	0.310	77.8	0.134
3	5.532	0.005	0.005	77.7	0.003
4	5.233	0.123	0.015	80.0	0.099
5	5.253	0.500	0.500	77.7	0.000
6	5.626	0.000	0.000	77.5	0.000
7	7.227	0.941	0.314	86.2	0.198
8	7.423	1.074	0.662	88.7	0.092
9	7.423	1.188	0.718	87.4	0.077
10	8.104	0.000	0.000	82.4	0.003
11	7.533	0.556	0.755	81.2	0.098
12	6.040	0.830	0.830	78.8	0.106
13	6.335	0.191	0.586	74.7	0.014
14	6.335	0.284	0.520	74.9	0.146
15	6.335	0.099	0.435	75.6	0.019
16	6.335	1.480	0.435	69.9	0.171
17	5.302	0.781	0.131	89.7	0.292
18	5.302	0.005	0.200	87.7	0.138
19	5.302	0.101	0.200	77.3	0.000
20	5.302	0.235	0.722	88.3	0.246
21	5.302	0.700	0.170	83.6	0.029
22	5.302	0.000	0.000	69.9	0.000
23	5.302	0.118	0.000	77.7	0.003
24	5.302	0.949	0.455	77.7	0.060
25	5.302	0.552	0.422	83.2	0.063
26	5.302	1.522	1.246	82.7	0.197
27	5.302	1.147	1.246	82.7	0.227
28	5.302	4.547	2.087	79.0	0.334
29	5.302	2.547	1.246	79.0	0.227
30	5.302	4.547	2.087	79.0	0.334
SUM	162.187	25.459	17.682	-	-
AVG	5.406	0.982	0.589	79	0.109
NBSID	Q0C1		C1CC		N100

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT STORAGE PERFORMANCE

SITE: CHARLOTTE MEM. HCSP. & MFC. CENT. SOLAR/2010-79/06
REPORT PERIOD: JUNE, 1979

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORAGE MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	C.744	C.256	0.288	121	0.730
2	C.640	C.333	C.155	126	0.768
3	C.040	C.316	-C.421	123	-0.653
4	C.220	C.295	-C.134	117	-0.730
5	C.655	C.229	-C.367	119	1.011
6	C.046	C.229	-C.233	111	-1.169
7	C.233	C.333	-C.233	113	0.025
8	1.451	C.403	-C.182	122	1.128
9	C.075	C.476	-C.224	132	1.176
10	C.087	C.399	-C.332	126	0.850
11	C.867	C.450	-C.342	127	0.821
12	C.252	C.872	-C.265	122	0.811
13	C.015	C.179	-C.264	111	1.222
14	C.015	C.413	-C.264	118	1.108
15	C.064	C.233	-C.254	105	1.156
16	C.502	C.509	-C.277	127	0.476
17	C.181	C.333	-C.318	118	0.478
18	C.554	C.393	-C.109	124	0.789
19	C.050	C.545	-C.317	123	1.100
20	C.180	C.550	-C.417	130	1.103
21	C.754	C.530	-C.360	122	1.170
22	C.360	C.586	-C.260	126	1.151
23	C.502	C.668	-C.650	123	1.128
24	C.765	1.879	-C.612	107	1.257
25	1.255	1.744	-C.180	98	1.208
SUM	16.486	18.578	-1.370	-	-
AVG	C.550	C.619	-C.046	121	1.044
NBS ID	G2CC	G2C1	G2C2		NI08

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT FCT WATER SUBSYSTEM

SITE: CHARLOTTE MEM. HCSP. 8 MED. CENT.
REPORT PERIOD: JUNE, 1979

SOLAR/2010-79/06

DAY	HOT WATER LOAD MILLION BTU	SOLAR FR. OF LOAD PER CENT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FCSIL FUEL MILLION BTU	ELECT ENRGY SAVING MILLION BTU	FOSSIL ENRGY SAVING MILLION BTU	SUP. WAT. TEMP DEG F	HOT WAT. TEMP DEG F	HOT WATER USED GAL
1	0.062	100	0.262	NOT APPLICABLE	0.000	0.000	0.000	0.000	NOT APPLICABLE	74	116	172
2	0.001	100	0.001	0.000	0.000	0.000	0.000	0.000	0.000	82	120	21
3	0.073	100	0.180	0.000	0.000	0.000	0.000	0.000	0.000	75	112	117
4	0.064	100	0.235	0.000	0.000	0.000	0.000	0.000	0.000	75	115	116
5	0.051	100	0.208	0.000	0.000	0.000	0.000	0.000	0.000	75	111	111
6	0.063	100	0.190	0.000	0.000	0.000	0.000	0.000	0.000	75	117	117
7	0.003	100	0.066	0.000	0.000	0.000	0.000	0.000	0.000	79	118	111
8	0.085	100	0.226	0.000	0.000	0.000	0.000	0.000	0.000	81	122	117
9	0.077	100	0.231	0.000	0.000	0.000	0.000	0.000	0.000	77	122	117
10	0.075	100	0.234	0.000	0.000	0.000	0.000	0.000	0.000	78	122	117
11	0.052	100	0.225	0.000	0.000	0.000	0.000	0.000	0.000	78	122	117
12	0.081	126	0.156	0.000	0.000	0.000	0.000	0.000	0.000	78	109	118
13	0.080	91	0.195	0.000	0.000	0.000	0.000	0.000	0.000	77	115	118
14	0.057	100	0.166	0.000	0.000	0.000	0.000	0.000	0.000	77	109	118
15	0.077	100	0.225	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
16	0.012	100	0.205	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
17	0.011	100	0.189	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
18	0.084	100	0.255	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
19	0.078	100	0.255	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
20	0.048	100	0.234	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
21	0.079	100	0.237	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
22	0.048	100	0.111	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
23	0.002	100	0.110	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
24	0.002	100	0.110	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
25	0.002	100	0.110	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
26	0.002	100	0.110	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
27	0.002	100	0.110	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
28	0.002	100	0.110	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
29	0.002	100	0.110	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
30	0.002	100	0.110	0.000	0.000	0.000	0.000	0.000	0.000	78	122	118
SUM	1.520	-	6.639	N.A.	0.272	0.272	N.A.	6.639	N.A.	-	-	4260
AVG	0.051	96	0.221	N.A.	0.009	0.009	N.A.	0.221	N.A.	78	117	142
NBS	Q302	N300	Q300	Q303	Q301	Q305	Q306	Q311	Q313	N305	N307	N308

* DENOTES UNAVAILABLE DATA.
DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SCLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT SPACE HEATING SUBSYSTEM

SITE: CHARLOTTE MEM. HOSP. & MED. CENT.
REPORT PERIOD: JUNE, 1979

SOLAR/2010-79/06

DAY OF MON.	SPACE HEATING LOAD MILLION BTU	SOLAR FR. OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FCSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG TEMP DEG. F	AMB TEMP DEG. F
1	0.794	1	0.011	0.005	0.783	0.783	0.011	0.011	0.011	73	74
2	0.722	0	0.000	0.000	0.722	0.722	0.000	0.000	0.000	73	73
3	0.826	0	0.000	0.000	0.826	0.826	0.000	0.000	0.000	72	71
4	0.810	0	0.000	0.000	0.810	0.810	0.000	0.000	0.000	73	72
5	0.806	0	0.000	0.000	0.806	0.806	0.000	0.000	0.000	73	72
6	0.798	0	0.000	0.000	0.798	0.798	0.000	0.000	0.000	73	72
7	0.788	0	0.000	0.000	0.788	0.788	0.000	0.000	0.000	73	72
8	0.714	0	0.000	0.000	0.714	0.714	0.000	0.000	0.000	73	72
9	0.699	0	0.000	0.000	0.699	0.699	0.000	0.000	0.000	73	72
10	0.736	0	0.000	0.000	0.736	0.736	0.000	0.000	0.000	73	72
11	0.808	0	0.000	0.000	0.808	0.808	0.000	0.000	0.000	73	72
12	0.819	0	0.000	0.000	0.819	0.819	0.000	0.000	0.000	73	72
13	0.854	0	0.000	0.000	0.854	0.854	0.000	0.000	0.000	73	72
14	0.824	0	0.000	0.000	0.824	0.824	0.000	0.000	0.000	73	72
15	0.928	0	0.000	0.000	0.928	0.928	0.000	0.000	0.000	73	72
16	1.268	18	0.042	0.022	0.882	0.882	0.022	0.042	0.042	70	68
17	1.200	4	0.005	0.000	0.380	0.380	0.000	0.000	0.000	65	60
18	0.069	0	0.000	0.000	0.174	0.174	0.000	0.000	0.000	65	60
19	2.422	0	0.000	0.330	1.422	1.422	0.330	0.895	0.895	69	68
20	2.332	0	0.000	0.451	2.252	2.252	0.451	0.000	0.000	71	70
21	4.336	0	0.011	0.452	3.360	3.360	0.011	0.000	0.000	72	71
22	4.306	0	0.037	0.445	3.264	3.264	0.037	0.004	0.004	72	70
23	4.346	0	0.000	0.450	3.363	3.363	0.000	0.006	0.006	72	70
24	4.363	0	0.000	0.448	3.363	3.363	0.000	0.000	0.000	72	70
25	4.533	0	0.000	0.451	3.334	3.334	0.000	0.000	0.000	71	67
26	4.409	0	0.000	0.448	3.364	3.364	0.000	0.000	0.000	71	67
27	2.653	15	0.352	0.201	2.262	2.262	0.352	0.392	0.392	72	70
28	1.558	39	0.604	0.068	0.954	0.954	0.604	0.604	0.604	70	67
29	2.127	57	1.202	0.121	0.925	0.925	1.202	1.202	1.202	69	65
SUM	64.736	-	3.474	4.956	61.242	61.242	3.474	3.474	3.474	-	-
AVG	2.158	5	0.116	0.165	2.041	2.041	0.116	0.116	0.116	71	73
NBS	Q402	N400	Q400	Q403	Q401	Q410	Q415	Q417	Q417	N406	N113

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SCLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT ENVIRONMENTAL SUMMARY

SOLAR/2010-79/C6

SITE: CHARLOTTE MEM. PCSP. & MED. CENT.
REPORT PERIOD: JUNE, 1979

DAY OF MONTH	TOTAL INSOLATION BTU/SQ. FT	DIFFUSE INSOLATION BTU/SQ. FT	AMBIENT TEMPERATURE DEG F	DAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	1145	NCT	74	82	NCT	216	2
2	1516		79	88		0	1
3	1685		73	77		207	2
4	1239		71	76		31	2
5	1314		72	80		183	2
6	592		72	77		177	3
7	1648		77	75		147	3
8	1813		78	86		142	3
9	1062		77	82		0	3
10	1574		71	74		208	3
11	2016		77	81		40	5
12	1987		77	82		0	2
13	1577		71	74		58	2
14	1580		71	74		63	3
15	711		66	75		49	4
16	638		60	59		359	6
17	1816		68	59		261	3
18	1337		78	87		150	2
19	1337		71	87		40	3
20	1741		77	77		61	4
21	1518		77	83		183	2
22	1858		76	88		0	2
23	1566		75	83		209	3
24	2066		67	65		*	2
25	1698		70	72		40	6
26	1673		70	77		44	3
27	1363		74	83		0	3
28	1553		75	82		178	1
29			75	79		200	2
30							
SUM	40345	N.A.	-	-	-	-	-
AVG	1345	N.A.	73	79	N.A.	*	3
NBS ID	Q001		N113			N115	N114

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N.A. DENOTES NOT APPLICABLE DATA.

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